

Claims

We claim:

1. A Raman endoscope comprising:
  - 5 a flexible tubular housing having a first optical waveguide for delivering excitation light from a proximal end of the housing to a distal end of the housing;
  - 10 a coherent optical fiber bundle positioned within the tubular housing to collect radiation at the distal end of the housing and deliver the collected radiation to the proximal end;
  - 15 a focal plane array sensor that is optically coupled to the proximal end of the collection bundle to detect radiation having a wavelength in the range of 1-2 microns.
2. The Raman endoscope of Claim 1 further comprising a laser optically coupled to the proximal end of the optical waveguide.
3. The Raman endoscope of Claim 1 further comprising  
20 a broadband light source coupled to the proximal end of the optical waveguide.
4. The Raman endoscope of Claim 1 further between the proximal end of the collection bundle and the sensor.
- 25 5. The Raman endoscope of Claim 1 further comprising a visible light imaging detector coupled to the proximal end of the collection bundle.

6. The Raman endoscope of Claim 1 further comprising a plurality of optical fibers for illumination and excitation of an object to be imaged.
- 5 7. The Raman endoscope of Claim 1 wherein the sensor comprises palladium silicide charge coupled device.
8. The Raman endoscope of Claim 1 wherein the sensor comprises a platinum silicide charge coupled device.
- 10 9. The Raman endoscope of Claim 1 wherein the sensor comprises a Schottky barrier sensor array.
10. A method for Raman imaging of tissue comprising:  
inserting an endoscope into a body lumen,  
the endoscope having an optical waveguide for  
15 delivering excitation light through the endoscope  
and onto tissue to be imaged adjacent a distal end  
of the endoscope;  
directing laser radiation through the optical  
waveguide and onto the tissue to excite Raman  
20 scattered light within the tissue;  
detecting the Raman scattered light with a  
focal plane array sensor to detect radiation  
having a wavelength in the range of 1-2 microns.
11. The method of Claim 10 further comprising coupling  
25 a Nd:YAG laser to the optical waveguide.
12. The method of Claim 10 further comprising coupling a laser diode emitting light in the range of 800-1200 nm.

13. The method of Claim 10 further comprising coupling a broadband light source to the endoscope to illuminate the tissue to be imaged.

5 14. The method of Claim 10 further comprising forming a plurality of images at different infrared wavelengths with the sensor.

Sub B1  
10 15. A Raman endoscope comprising:  
an endoscope having an optical fiber extending from a proximal end to a distal end;  
a focal plane array sensor at the distal end of the endoscope to detect radiation directed onto the distal end of the endoscope;  
15 a laser optically connected to the optical fiber at the proximal end of the endoscope to irradiate an object to be imaged; and  
a memory connected to the sensor for storing an electronic representation of the detected radiation.

20 Sub C2  
16. The Raman endoscope of Claim 15 further comprising an additional optical fiber to direct light from a broadband light source onto the object to be imaged.

25 17. The Raman endoscope of Claim 16 further comprising a detector to record a visible image of the object.

18. The Raman endoscope of Claim 15 further comprising a data processor and a comparator for comparing images at different wavelengths.

19. The Raman endoscope of Claim 15 further comprising an optical system on the distal end of the endoscope.

*Sub D2* 20. The Raman endoscope of Claim 15 further comprising a filter system that filters light directed onto the sensor that selectively transmits light having one or more frequencies selected from the group consisting of  $700\text{ cm}^{-1}$ ,  $960\text{ cm}^{-1}$ ,  $1070\text{ cm}^{-1}$ ,  $1745\text{ cm}^{-1}$ ,  $1737\text{ cm}^{-1}$  and  $1440\text{ cm}^{-1}$ .

*Add B2*

*add E4*

00745500 111035